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Integrating Design Thinking (DT) and Project-Based Learning (PjBL) with Writing Literacy for Advancing Creative, Collaborative, and Critical Writing Skills among EFL Learners

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Abstract

This study explores the DT and PjBL to enhance creative, collaborative, and critical writing skills among EFL learners. A post-test-only quasi-experimental design was employed, involving 65 students from an English Education Program, aged 20 to 22, divided into three groups: DT, PjBL, and a integration of both. The instruments used to evaluate creative, collaborative, and critical writing skills were thoroughly validated for reliability, demonstrating good convergent validity and internal consistency. Additionally, Cronbach's alpha confirmed high reliability across all constructs, ensuring an accurate assessment of the participants' writing proficiency. Data analysis was carried out using MANCOVA, with writing literacy as a covariate to control for variability in individual differences. The results indicate that integrating DT and PjBL significantly improves writing performance across all skill categories, with the combined approach yielding better outcomes than the individual application of each approach. This study highlights the effectiveness of integrating DT and PjBL in fostering deeper engagement, critical thinking, and innovation in writing, while preparing students for real-world challenges. These findings suggest that the integrated approach offers a comprehensive framework for improving EFL writing instruction, with the potential for broader implementation in various educational settings.

Keywords: *Academic Writing, Integrating Design Thinking, Project-Based Learning, Writing Literacy*

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Introduction

Writing plays a crucial role in language acquisition, yet many EFL learners face difficulties in expressing their ideas clearly in written form (Haji, 2024; Taye & Mengesha, 2024). By integrating Design Thinking (DT) and Project-Based Learning (PjBL) with learners' writing literacy, this study intends to establish a more immersive and highly enriching educational setting that promotes the development of critical writing skills necessary for both academic and professional success (ALKaab, 2024; Valizadeh, 2022). DT, with its focus on empathy, ideation, and prototyping, encourages deeper learner engagement in the writing process (Alzahrani et al., 2021). This approach encourages students to consider the needs and perspectives of their audience, which is crucial for effective communication. In terms of writing, DT promotes critical thinking as students analyze problems and generate innovative solutions through their written work. Research indicates that when students apply DT principles, they are more likely to produce writing that is coherent, engaging, and relevant to their intended audience (Alrouji, 2020; Masadeh, 2021).

PjBL enhances DT by offering a structured approach that enables students to proficiently apply their writing competence in real-world, practical context. PjBL encourages learners to work collaboratively on projects that require them to produce various forms of written communication, such as reports, presentations, and reflective essays (Ismail et al., 2020; Miri et al., 2024). This hands-on experience enhances technical writing skills and fosters collaboration and creativity, as students engage in brainstorming, drafting, and revising their work together. Studies have shown that PjBL significantly improves students' writing abilities by providing authentic contexts for writing, which fosters motivation and engagement (Ho & Savignon, 2013; Hu, 2016). Moreover, writing literacy serves as a foundational element in this integration. Learners who possess strong writing skills in their first language are often better equipped to tackle writing tasks in a foreign language (Prasaty & Gustary, 2023). This existing literacy can be leveraged to enhance the learning experience, allowing students to build upon their prior knowledge while developing new writing skills in English. By recognizing and utilizing these pre-existing skills, educators can create a more effective and responsive curriculum that meets the diverse needs of EFL learners (Nosratinia & Razavi, 2016; Song et al., 2024).

Despite the recognized importance of integrating creative instructional approaches such as DT and PjBL in EFL contexts, there remains a significant gap in the literature regarding the combined application of these approaches to enhance writing skills. Specifically, the problem lies in the lack of empirical studies that examine how the integration of DT and PjBL, alongside writing literacy, can effectively advance critical, collaborative, and creative writing skills among EFL learners. This issue is significant because many EFL learners continue to face challenges in writing, often due to traditional teaching approaches that do not adequately address their needs for engagement and skill development (Nugrahini & Rakhmawati, 2022).

Current research shows that although both DT and PjBL have been studied separately in EFL education, there is a significant gap in studies examining their integration. Most

existing literature focuses on the benefits of one approach without considering how they can complement each other to enhance writing skills (Akbarzadeh et al., 2020; Şenel, 2018). Furthermore, while some studies have highlighted the importance of writing literacy, few have investigated how this literacy can be effectively systematically integrated into the learning process when employing DT and PjBL (Alhamadi & Aljuran, 2021; Syafrizal et al., 2020). This research aims to fill this gap by providing a comprehensive examination of how these elements can work together to improve writing outcomes for EFL learners.

The holistic approach to integrating DT and PjBL with writing literacy highlights the novelty of this study. By examining the interplay between these elements, the study seeks to create a framework that enhances creative, collaborative, and critical writing skills among EFL learners. The principal goal of the research is to identify effective strategies for implementing this integrated approach in EFL classrooms, thereby providing educators with practical tools to improve writing instruction (Selcuk, 2017; Wijaya, 2022). Furthermore, this study aims to expand the existing research by providing insights into how writing literacy can be utilized to enhance the learning experience.

The urgency of this research is underscored by the pressing need to improve writing skills among EFL learners, who often struggle to articulate their thoughts effectively in written form. By integrating DT and PjBL, this study has the potential to provide a more interactive and collaborative approach to writing instruction, which can enhance student motivation and engagement (Abbas & Fathira, 2022; Liu, 2013). The wider impact of this research contributes to enhancing English language education on a global scale, aiming to equip learners with the critical, collaborative, and creative skills essential for success in the 21st century (Bashiri & Shahrokhi, 2015; Patra et al., 2022). The findings of this study have the potential to guide best practices in EFL teaching, helping to develop more effective and adaptable educational frameworks that address the diverse needs of learners. This research explores the integration of DT and PjBL with writing literacy to enhance creative, collaborative, and critical writing skills among EFL learners. By addressing gaps in the literature and providing a thorough analysis of this integration, the study aims to contribute to the improvement of writing instruction in EFL contexts, ultimately benefiting both educators and students.

DT in Educational Pedagogy

DT focuses on a human-centered approach to problem-solving, concentrating on empathy, idea generation, prototyping, and testing. Its five core principles: empathy, define, ideate, prototype, and test help educators understand students' needs, frame problems, generate creative solutions, and iterate based on feedback (Luka, 2020; Schumacher & Mayer, 2018). By focusing on empathy, this approach ensures that the learning experience is aligned with students' perspectives, fostering a deeper connection to the material and improving engagement (Luka, 2020). Furthermore, DT encourages a collaborative learning environment, where students share ideas and learn from one another, which is crucial for developing critical thinking and creativity (Hatt et al., 2023)

Applied in educational settings, DT enhances engagement and prepares students for Practical challenge by promoting active and interdisciplinary learning (Hatt et al., 2023; Luka, 2020). It is especially effective in developing writing skills through an iterative process of drafting, feedback, and revision, encouraging students to view writing as a process and experiment with different styles (Luka, 2020). The collaborative nature of DT allows for peer feedback, creating a supportive environment that improves writing skills, confidence, and motivation (Hatt et al., 2023). In these ways, DT provides a strong platform for developing fundamental communicative, critical thinking, and problem-solving competencies essential for academic and professional success.

PjBL and Writing Skills Development

Students engaged in PjBL work on extended projects that culminate in a final product or presentation, fostering inquiry-based learning and the integration of knowledge across various disciplines (Chiang & Lee, 2016; Markula & Aksela, 2022). This approach empowers learners by giving them control over their educational process, enhancing motivation and engagement while building crucial skills like problem-solving, collaboration, and communication (Belwal et al., 2020; Dogara et al., 2020). Addressing real-world issues through this method not only improves knowledge retention but also equips students to handle complex, authentic challenges.

Research consistently demonstrates that PjBL effectively improves writing skills. Students are required to produce various written outputs such as reports and presentations, allowing them to apply and refine their writing abilities in practical contexts (Ningzi et al., 2021). The authentic nature of these tasks boosts motivation and leads to enhanced writing performance (Hakimah, 2023). The iterative process, involving revision based on continuous feedback, further strengthens students' writing competence (Cahyani, 2021; Hakimah, 2023). Additionally, the collaborative environment in PjBL promotes critical and creative thinking, as students work in teams, exchange ideas, and provide constructive feedback, preparing them with critical competencies for future academic and professional success (Hussein, 2021; Usmeldi & Amini, 2022).

Writing Literacy in Foreign Language Learning

Writing literacy greatly influences EFL learners by shaping their ability to compose texts in a foreign language. Studies indicate that students possessing advanced writing skills in their first language tend to perform better in foreign language writing tasks, as cognitive processes like organizing thoughts and structuring arguments are transferable across languages (Van Beuningen et al., 2012; Yemez & Dikilitaş, 2022). Additionally, a solid foundation in writing boosts learners' confidence, increasing their motivation and engagement in writing activities (Purnama, 2021). This correlation suggests that educators should assess students' prior writing literacy to design instruction that builds on their existing competencies (Sanavi & Tarighat, 2014).

Writing literacy plays a critical role in helping learners develop advanced writing skills in EFL contexts. When students draw on their established writing abilities, they are better

equipped to handle more complex tasks like argumentative essays or research papers (Sanavi & Tarighat, 2014). Instructional strategies that encourage critical thinking and collaboration, such as peer feedback, allow students to refine their writing and explore diverse perspectives (Maryanto et al., 2018). Recognizing and leveraging these prior skills not only improves technical proficiency but also fosters creativity and critical thinking, essential for effective writing in a foreign language (Purnama, 2021).

The Integration of DT and PjBL

Integrating DT with PjBL presents an effective strategy for strengthening students' analytical thinking and problem-solving skills. This combination leverages DT's focus on empathy and iterative design, along with PjBL's emphasis on real-world projects, encouraging students to examine problems from multiple perspectives and develop creative solutions (Hidayati et al., 2022; Naqvi et al., 2023). By applying knowledge in practical, real-life contexts, students achieve a deeper understanding and greater retention of concepts (Liu, 2023). Furthermore, this integrated approach fosters teamwork, where students collaborate to brainstorm ideas, create prototypes, and reflect on their learning experiences, ultimately improving communication skills and preparing them for professional collaboration (Rijal et al., 2021).

This integration is particularly effective in developing writing skills. DT helps students empathize with their audience, tailoring their writing to be more engaging and relevant (Yusuf et al., 2022). PjBL complements this by offering authentic tasks such as reports, presentations, and narratives, which develop technical writing skills while fostering creativity and critical thinking (Funny et al., 2019; Suteja & Setiawan, 2022). The iterative process of both approaches encourages continuous refinement of students' work through feedback, enhancing their writing proficiency over time (Amin et al., 2020). Overall, the combination of DT and PjBL transforms learning environments, creating dynamic, student-centered spaces that promote innovation, collaboration, and deeper engagement in writing and problem-solving (Dharma et al., 2020; Khalaf et al., 2013).

Developing Critical, Collaborative, and Creative Writing Skills in EFL Learners

Critical writing encompasses the capacity to critically assess, appraise, and synthesize information effectively, supporting arguments with evidence and logical reasoning, which is essential in academic writing (Al Shlowiy & Layali, 2020). Collaborative writing skills focus on the capacity to work with others in creating written content, sharing ideas, giving feedback, and negotiating meaning in a group (Meletiadou, 2021). Creative writing, on the other hand, emphasizes the competency to convey thoughts and emotions imaginatively, using narrative techniques and stylistic choices to engage readers (Aghayani & Janfeshan, 2020). Together, these three skills create a comprehensive framework for EFL learners to communicate effectively and creatively through their writing.

Several factors contribute to the development of these writing skills. Exposure to various writing styles and genres helps learners grasp different writing conventions, enhancing critical

and creative thinking (Ghufron & Ermawati, 2018). Collaborative learning and peer assessments allow students to engage with others' work, learn from feedback, and refine their writing (Meletiadou, 2021). Self-directed learning strategies also foster independence and critical thinking in the writing process (Aghayani & Janfeshan, 2020). Additionally, integrating technology and multimedia enriches the writing experience, offering diverse platforms for expression and collaboration (Mujiono & Fatimah, 2022). By leveraging these factors, educators can help EFL learners develop strong writing proficiency, critical thinking, and creativity in their written communication.

Method

Research Design and Participants

This study employs a post-test-only non-equivalent groups quasi-experiment design with students selected through criterion-based sampling, specifically those who have completed the Essay Writing course. The three experimental groups were subjected to different treatments involving DT, PjBL and an integration of both DT and PjBL. After the instructional sessions, creative writing, collaborative writing, and critical writing abilities were measured through a post-test. The analysis was conducted using MANCOVA, with writing literacy as the covariate to control for literacy variables and identify significant differences between the groups, while also assessing the effectiveness of each instructional method.

The study involved 65 undergraduate students, comprising 48 males and 17 females, aged between 18 and 22 years, all enrolled in the English Language and Literature Departments at private university, Malang Indonesia. The participants were systematically selected to maintain consistency in their academic background, minimizing variability due to differences in prior writing experience. This approach ensured that the data accurately and representatively captured writing abilities relevant to the research context. The context of this research was shaped by the increasing emphasis on developing students' critical and analytical writing abilities in higher education, given their importance for academic and professional success.

Measures

The instruments used in this study encompass three main components: creative writing, collaborative writing, and critical writing. These were developed by the researchers, referring to previous studies to ensure relevance and reliability. The creative writing instrument was based on the studies of Alhamadi & Aljuran (2021), as well as Fürst et al. (2017), which focused on measuring students' abilities to produce original, innovative writing and express ideas creatively, considering cohesion and writing style. The collaborative writing instrument was adapted from the Works of Chen & Yu (2019), as well as Rimayah et al. (2021), which assessed students' ability to work effectively in teams, distribute roles, use collaborative technologies, and integrate diverse perspectives in the writing process. The critical writing instrument was adapted from the studies by Bobkina & Stefanova (2016), as well as Chason et al. (2017), aimed at evaluating students' critical thinking skills, logical argument construction, and deep evaluation of

sources used in academic writing. These instruments were developed based on theories previously outlined by the researchers and validated through Confirmatory Factor Analysis (CFA) to ensure each measured item aligned with the underlying theoretical factors. Additionally, the instruments' reliability was assessed using approaches such as Average Variance Extracted (AVE), Composite Reliability (CR), and Cronbach's Alpha were employed to ensure consistency and reliability in assessing the relevant variables. The detailed validity and reliability values can be found in Tables 1 and 2, respectively.

Table 1

Validity and Reliability Assessment for the Creative, Collaborative, and Critical Writing Constructs

Aspect	CR	AVE	Alpha Cronbach	Conclusion
Creative Writing	0.919	0.696	0.919	Adequate
Collaborative Writing	0.954	0.737	0.904	Adequate
Critical Writing	0.910	0.836	0.899	Adequate

Table 1 shows that all aspects of creative, collaborative, and critical writing have adequate validity and reliability based on the values of CR, AVE, and Alpha Cronbach. For creative writing, the CR value is 0.919, the AVE is 0.696, and the Alpha Cronbach is 0.919, indicating very good internal consistency and sufficient validity. Similarly, for collaborative writing, the CR is 0.954, the AVE is 0.737, and the Alpha Cronbach is 0.904, and for critical writing, the CR is 0.910, the AVE is 0.836, and the Alpha Cronbach is 0.899. Based on these values, all three aspects of writing demonstrate good validity and reliability for further measurements.

Table 2

Goodness of Fit for the Creative, Collaborative, and Critical Writing Constructs

Aspect	df	Chi-square	Probability	CMIN/DF	RMSEA	GFI	AGFI	TLI	CFI
Creative Writing	83	118.238	.007	1.425	.065	.875	.820z	.945	.956
Collaborative Writing	81	86.528	.317	1.068	.026	.903	.856	.989	.992
Critical Writing	81	88.374	.269	1.091	.030	.900	.852	.986	.989

Table 2 presents the outcomes of the goodness-of-fit test for the creative, collaborative, and critical writing constructs. For creative writing, the CMIN/DF value is 1.425, RMSEA is 0.065, GFI is 0.875, AGFI is 0.820, TLI is 0.945, and CFI is 0.956, indicating that the model approaches a good fit, although the Chi-square probability of 0.007 suggests some misfit in certain parameters. In contrast, for collaborative writing, the CMIN/DF value is 1.068, RMSEA is 0.026, GFI is 0.903, AGFI is 0.856, TLI is 0.989, and CFI is 0.992, demonstrating an excellent fit with a Chi-square probability of 0.317, which supports the overall model fit. Similarly, for critical writing, the CMIN/DF value is 1.091, RMSEA is 0.030, GFI is 0.900, AGFI is 0.852, TLI is 0.986, and CFI is 0.989.

.986, and CFI is 0.989, showing that the model also has a good fit.

Experimental Procedure

The treatment process in this study was implemented through three structured approaches: DT, PjBL and a integration of both approaches . For the group following the DT approach, students engaged in five key phases: Empathy, Problem Definition, Ideation, Prototyping, and Testing . These phases were carefully crafted to guide students in creating innovative solutions within an academic setting . The treatment began with the topic "Understanding Argumentation in Academic Texts" during the first session and advanced progressively to "Reflective Practices in Collaborative Writing" by the sixteenth session . Each phase aligned with specific learning objectives aimed at enhancing students' critical thinking and creative problem-solving abilities as they tackled academic challenges .

The group assigned to the PjBL method was instructed to complete a project in several stages, beginning with identifying the problem, followed by project planning, research, solution development, and concluding with presentations and reflections . The topics discussed in each session, from "Evaluating Sources through Critical Reading" to "Writing for International Readers," were designed to not only help students grasp theoretical concepts but also empower them to effectively utilize their knowledge in authentic, real-world contexts . This structured process aimed to develop practical collaboration and problem-solving skills among the students .

For the group exposed to the integrated approach combining DT and PjBL, the learning process blended the creative problem-solving elements of DT with the structured, project-based framework of PjBL . This hybrid approach began with an empathy-driven approach to understanding problems, moving through idea generation and prototyping, and culminating with testing the solutions through research and project presentations . Each session, from the first to the sixteenth, followed the same topics as the other groups, but the integrated approach offered a more dynamic and holistic learning experience, providing students with a comprehensive toolkit for tackling complex academic tasks .

The objective of this experimental treatment was to foster critical thinking, innovation, and collaboration in students as they engaged with the various topics . By tailoring the stages in each method to meet these goals, the study aimed to significantly improve students' abilities to solve problems and apply conceptual understanding to practical context . Every instructional procedure was meticulously designed to ensure that students not only understood theoretical frameworks but were also able to translate these theories into actionable, innovative projects .

Results

Normality and Homogeneity Test Results for Creative, Collaborative, and Critical Writing

As indicated by the results of the Shapiro-Wilk test in the normality evaluation, the three

variables tested, namely Creative Writing, Collaborative Writing, and Critical Writing, demonstrated a normal distribution of residuals. The Shapiro-Wilk statistic for Creative Writing was 0.933 with a significance value of 0.450, for Collaborative Writing it was 0.940 with a significance value of 0.165, and for Critical Writing it was 0.967 with a significance value of 0.076. All three significance values are greater than 0.05, thus it can be concluded that there are no significant deviations from the assumption of normality in these three variables. This indicates that the residual data conforms to a normal distribution pattern.

In reference to Levene's assessment of error variance equality, the three variables tested, namely Creative Writing, Collaborative Writing, and Critical Writing, met the assumption of homogeneity. The significance values for all three were greater than 0.05, specifically 0.493, 0.124, and 0.400, respectively. This implies that there were no substantial differences in error variances across the groups, confirming that the variances are homogeneous.

Table 3

Multivariate Test Results for the Effect of Treatment Approaches on Writing Competence

Effect		Value	F	Hypothesis df	Error df	Sig	Partial Eta Squared
DT-PjBL Integration approaches	Pillai's Trace	.704	10.861	6.000	120.000	.000	.352
	Wilks' Lambda	.347	13.714 ^b	6.000	118.000	.000	.411
	Hotelling's Trace	1.734	16.763	6.000	116.000	.000	.464
	Roy's Largest Root	1.645	32.895 ^c	3.000	60.000	.000	.622

The Multivariate Test results for the DT-PjBL integration variable demonstrate that all four statistical measures were significant (Table 3). Once writing competence was controlled for, the DT-PjBL integration variable showed a substantial impact on the dependent variables. Pillai's Trace was 0.704 with an F-value of 10.861 ($p < 0.000$), Wilks' Lambda was 0.347 with an F-value of 13.714 ($p < 0.000$), Hotelling's Trace was 1.734 with an F-value of 16.763 ($p < 0.000$), and Roy's Largest Root was 1.645 with an F-value of 32.895 ($p < 0.000$). All significance values indicate significant differences in the dependent variables based on the treatment, with a substantial effect, as indicated by Partial Eta Squared ranging from 0.352 to 0.622. This shows a significant simultaneous effect on the outcomes after controlling for writing competence.

Table 4

Between-Subjects Effects on Creative, Collaborative, and Critical Writing by Treatment Approaches

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig	Partial Eta Squared
DT-PjBL	Creative Writing	10.314	2	5.157	7.592	.001	.199
Integration Approaches	Collaborative Writing	30.517	2	15.259	28.573	.000	.484
	Critical Writing	34.154	2	17.077	22.101	.000	.420

Referring to the Tests of Between-Subjects Effects (Table 4), the results reveal that the independent variables had a significant impact on all three dependent variables: Creative Writing, Collaborative Writing, and Critical Writing. Specifically, for Creative Writing, an F-value of 7.592 and a significance value of 0.001 indicate a notable influence of the independent variables on creative writing outcomes. In Collaborative Writing, the F-value was 28.573 with a significance value of 0.000, showing a highly significant effect of approaches on collaborative writing skills. Meanwhile, for Critical Writing, the F-value was 22.101 with a significance value of 0.000, indicating a significant influence of approaches on critical writing skills. The Partial Eta Squared values, ranging from 0.199 to 0.484, demonstrate the magnitude of approaches' effect on the three dependent variables, with the largest impact observed in Collaborative Writing. This confirms that the approaches applied in this study had a significant and substantial effect on writing skills in all three categories.

Table 5

Pairwise Comparisons of Treatment Approaches for Creative, Collaborative, and Critical Writing

Dependent Variable	(J) Treatments	Mean Difference (I-J)	Std Error	Sig ^b	95% Confidence Interval for Difference ^b	
					Lower Bound	Upper Bound
Creative Writing	PjBL	.167	.253	1.000	-.456	.789
	Integration	-.750*	.255	.014	-1.379	-.122
	DT	-.167	.253	1.000	-.789	.456
	Integration	-.917*	.249	.001	-1.530	-.304
	DT	.750*	.255	.014	.122	1.379
	PjBL	.917*	.249	.001	.304	1.530
Collaborative Writing	PjBL	-.272	.224	.688	-.825	.280
	Integration	-1.586*	.226	.000	-2.144	-1.029
	DT	.272	.224	.688	-.280	.825
	Integration	-1.314*	.221	.000	-1.858	-.770
	DT	1.586*	.226	.000	1.029	2.144
	PjBL	1.314*	.221	.000	.770	1.858
Critical Writing	PjBL	-.533	.270	.158	-1.197	.131
	Integration	-1.757*	.272	.000	-2.428	-1.086
	DT	.533	.270	.158	-.131	1.197
	Integration	-1.224*	.266	.000	-1.878	-.570
	DT	1.757*	.272	.000	1.086	2.428
	PjBL	1.224*	.266	.000	.570	1.878

Based on the results of the Pairwise Comparisons for the independent variable (Table 5), there are significant differences between several treatment approaches on the three dependent variables: Creative Writing, Collaborative Writing, and Critical Writing. In the Creative Writing variable, the Integration method showed a significant difference compared to DT with a mean difference of -0.750 ($p = 0.014$), and compared to PjBL with a mean difference of -0.917 ($p = 0.001$). However, no significant difference was found between DT and PjBL. Meanwhile, in Collaborative Writing, a significant difference was observed between Integration and DT with a mean difference of -1.586 ($p = 0.000$), and between Integration and PjBL with a mean difference of -1.314 ($p = 0.000$). However, similar to Creative Writing, there was no considerable difference between DT and PjBL. In the Critical Writing variable, the findings revealed a significant difference between the Integration and DT groups, with a mean difference of -1.757 ($p = 0.000$), as well as between the Integration and PjBL groups, showing a mean difference of -1.224 ($p = 0.000$). However, no notable difference was detected between the DT and PjBL groups. From these results, it can be inferred that the DT-PjB integration exerted a more substantial impact on the three tested writing skills compared to DT and PjBL. This difference underscores that the selected teaching method serves as a fundamental factor in shaping learners' writing abilities.

Discussion

The results reveal that integrating DT and PjBL is more effective in enhancing writing skills compared to using DT or PjBL independently. This finding emphasizes the importance of a holistic approach in education, which not only focuses on a single method but combines several strategies to achieve better outcomes in advancing learners' writing competence (Mahajan et al., 2021). One reason why combining DT and PjBL can be more effective is that both strategies complement each other in terms of developing critical and creative thinking skills. PjBL has proven to enhance learners' analytical and collaborative skills, which are crucial in today's educational context. According to studies conducted by Tudor Car et al.(2019) and Zhou et al.(2023), PjBL has demonstrated its effectiveness in enhancing learners' analytical and collaborative skills, which are crucial in today's educational context. On the other hand, DT provides a framework that allows students to innovate and create better solutions for complex problems (Mahajan et al., 2021). By combining these two approaches, learners learn not only to write but also to engage in critical and creative writing, both of which are crucial skills for the 21st century (Voogt et al., 2013). However, there are also studies that show that using PjBL or DT separately can yield significant results in the development of writing skills. For example, some studies show that PjBL can enhance learners' critical thinking skills and writing abilities, although it is not as effective as the combination of both approaches (Budi et al., 2023; Choi et al., 2022). Other research shows that DT, when applied correctly, can also enhance learners' writing and critical thinking skills (Qoura & Zahran, 2018). This indicates that although the combination of both approaches

may be more effective, using either approach independently can still provide significant benefits.

Differences in methodology, context, and research samples can explain why some studies support these findings while others do not. For example, research conducted in different educational environments or with different populations of learners may yield different results. The findings of Cintamulya et al. (2023) and Rozy et al. (2019) demonstrate this. Furthermore, variations in the implementation of the PjBL and DT approaches can have an impact on the outcomes. Certain studies may adopt a more structured methodology, while others might employ a more flexible approach, both of which can influence the effectiveness of these approaches in enhancing writing skills (Prayitno et al., 2017). Furthermore, the social and cultural context of the research can also impact the results. For example, in some cultures, collaboration and teamwork may be more valued, which can make PjBL more effective, while in other contexts, an individual approach may be more appreciated (Indah, 2017; Shao & Purpur, 2016). Therefore, it is important to consider the context when comparing the findings of this research with previous studies. It is important to note that integrative approaches have pros and cons. Some researchers argue that focusing on a single approach can provide greater depth in mastering specific skills compared to a broader approach that may be less in-depth (Tilahun et al., 2022; Widyastuti, 2018). They contend that applying too many approaches simultaneously could overwhelm learners and prevent them from effectively mastering writing skills (Kandel, 2016). However, recent findings that demonstrate the effectiveness of this integrative approach could be a step forward in education, particularly in the context of developing writing skills. By combining DT and PjBL, learners can learn to think critically, collaborate, and innovate, all of which are essential skills for success in the modern world (Yuliana et al., 2023). Therefore, despite the opposing arguments, it is important to continue exploring and applying integrative approaches in education to achieve better outcomes in the development of students' writing skills.

This finding also indicates that the use of integrative approaches not only enhances overall writing skills but also specifically strengthens collaborative writing abilities, which are crucial in the context of modern education (Ismail et al., 2020). One of the arguments supporting this finding is that the integrative approach allows students to combine the strengths of both approaches, namely DT and PjBL. PjBL is known to be effective in encouraging learners to engage in real projects that require problem-solving and collaboration, which in turn can enhance critical thinking skills (Budarina et al., 2022). Conversely, DT focuses on the creative and innovative processes in problem-solving, which also contributes to the development of writing skills (Addawiyah, 2020). By integrating these two approaches, one can learn to collaborate in teams, share ideas, and produce better writing, which is at the heart of collaborative writing skills (Ismail et al., 2020). However, individual application of DT or PjBL yields different results in previous studies. Several studies indicate that although PjBL can enhance critical thinking skills, its impact on writing skills is not always significant

(Đžlena, 2020). Furthermore, other research shows that the independent application of DT can also yield positive results in the development of writing skills, although it may not be as effective as an integrative approach (Addawiyah, 2020). This indicates that although the integrative approach may be superior, the individual approach still holds value and can provide significant benefits in certain contexts.

The role of writing literacy in this research context is very important, considering the significant differences in the dependent variable based on the treatment, with substantial effects after controlling for writing literacy. This finding demonstrates that writing literacy serves not only as a foundation for writing skills but also as a factor that influences overall learning outcomes (Anh & Dan, 2021). Writing literacy encompasses the skills required to read, comprehend, and generate text efficiently. Studies show a positive relationship between learners' writing proficiency and their information literacy abilities. In this context, information literacy helps learners find and evaluate the information needed to write scientific articles, which in turn enhances their writing skills (Cintamulya et al., 2023). In other words, excellent writing literacy enables students to be more effective in organizing their ideas and conveying their arguments in writing. Moreover, writing literacy plays a role in fostering critical thinking skills. Research shows that learners with excellent literacy skills tend to be more capable of analyzing and evaluating information, which are essential skills in writing (Rachmawati et al., 2019). In the educational context, learners must not only write proficiently but also engage in critical thinking. However, there is also research indicating that not all writing literacy teaching approaches yield the same results. For example, in some contexts, traditional approaches may not be as effective as more innovative approaches in enhancing students' writing literacy (Bay et al., 2015). This shows that although writing literacy plays an important role, its effectiveness greatly depends on the teaching approaches applied and the setting in which learning occurs.

This study indicates that the integrative approach has a significant effectiveness in fostering writing skill development, including creative, collaborative, and critical writing skills. This finding underscores the importance of a holistic approach in teaching that not only combines various approaches but also considers the role of writing literacy as a key factor influencing learning outcomes. Writing literacy serves as a foundation that supports students in advancing their writing competence. By controlling the influence of independent and dependent variables, this research demonstrates that writing literacy not only enhances technical writing abilities but also strengthens students' critical and collaborative thinking skills. This aligns with previous studies that show a significant correlation between literacy skills and writing and critical thinking abilities (Anh & Dan, 2021; Cintamulya et al., 2023). Thus, the application of an integrative method supported by strong writing literacy can lead to significant advancements in students' writing abilities. This research provides evidence that to achieve optimal results in writing skill development, it is important to combine effective approaches and reinforce writing literacy as an essential aspect of the learning process.

Conclusion

EFL learners significantly enhance their creative, collaborative, and critical writing skills through the integration of DT and PjBL. This approach enables students to sharpen their critical and innovative thinking skills in solving real-world problems while also strengthening collaboration in writing. In the context of language education, this holistic strategy yields optimal outcomes by combining various learning approaches. In addition, strong writing literacy serves as an important foundation for promoting the development of complex cognitive skills. This method helps educators prepare EFL students, not only in improving their writing skills but also in facing complex challenges through better critical and collaborative thinking.

This integrative approach also provides learning flexibility by encouraging students to produce creative written works, actively participate in discussions, and consistently enhance their writing skills through a revision process driven by constructive feedback. This approach enhances students' responsibility for the final outcome and motivates them to be more engaged at every stage of writing, especially by linking creative ideas to real projects. In addition to strengthening group dynamics and interpersonal skills, this approach also serves as a foundation for developing a more responsive and relevant curriculum, both in academic and professional settings.

Future researchers are encouraged to further explore the integration of DT and PjBL with writing literacy skills across different educational levels and cultural contexts, utilizing larger and more diverse populations to understand the factors influencing its effectiveness. Additionally, the role of educational technology and innovative assessment approaches could be investigated to enhance the PjBL experience. For educational practitioners, this approach can be adapted into curricula that are more responsive to student needs, not only in writing but also in fostering critical thinking and collaborative skills across various subjects. Practitioners are advised to continually monitor student engagement and provide constructive feedback to ensure optimal development of cognitive and collaborative abilities.

Various limitations in this research should be acknowledged. The small sample size and the specific participant group limit the extent to which the findings are transferable to a larger population. Additionally, the research was conducted in a controlled academic environment, which may not capture the full complexity of real-world educational settings. The short duration of the intervention also restricts the ability to evaluate long-term effects on writing skill development. Furthermore, the study did not thoroughly account for individual differences in factors like prior language proficiency, motivation, and learning styles, which could have influenced the outcomes. Lastly, the potential benefits of incorporating digital tools and technology were not explored, leaving room for further investigation. Future studies could address these limitations to provide deeper and more applicable insights.

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Ethics Declarations

Competing Interests

The authors declare no conflicts of interest related to this publication. Every phase of the study, from design and data collection to analysis and interpretation, was conducted independently, ensuring the integrity of the research without any external interference.

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